

**Importation of Chinese Penjing
into the United States**

With Particular Reference to *Buxus sinica*

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A. Introduction

This pest risk assessment (PRA) was conducted by the United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Biological Assessment and Taxonomic Support Staff (USDA, APHIS, PPQ, BATS) on *Buxus sinica* penjing, established in a growing medium, from China. The results are expressed qualitatively (@high@ or @low@), rather than quantitatively (probabilities or frequencies). The risk assessment methodology and rating criteria can be found in the document: *Pathway-Initiated Pest Risk Assessment: Guidelines for Qualitative Assessments* (USDA, 1995) (available from the authors of this risk assessment). Authority for APHIS to regulate plant pests/plant products is derived from the Plant Quarantine Act of 1912, the Plant Pest Act of 1957, the Noxious Weed Act of 1974 and the Code of Federal Regulations, Title 7, Part 319, Subpart 37 (7 CFR 319.37- Nursery Stock, Plants, Roots, Bulbs, Seeds and Other Plant Products). The methods and terminology used to initiate, conduct, and report this PRA are consistent with guidelines provided by FAO (1995) and NAPPO (1995).

B. Risk Assessment

1. Initiating Event: Proposed Action

China has been exporting significant volumes of bare root bonsai plants into the United States for a number of years. In August, 1992 representatives of the China Animal and Plant Quarantine Service (CAPQ), requested permission to export penjing (landscape bonsai) established in growing media. A list of 112 plant species was submitted. From these plants; categorized by PPQ, as prohibited, postentry, and restricted; CAPQ was asked in January, 1994, to select five restricted species. Subsequently, CAPQ submitted a list of eight species, along with a list of pests or potential pests of each species. In April 1994, the BATS Staff identified five species as candidates for pest risk assessments: *Buxus sinica* (Buxaceae), *Ehretia (Carmona) microphylla* (Boraginaceae), *Podocarpus macrophyllus* (Podocarpaceae), *Sageretia thea (theazans)* (Rhamnaceae), and *Serissa foetida* (Rubiaceae).

There are special concerns associated with propagative material in growing media: the presence of biological contaminants may not be discernible by visual inspection (this includes both pre shipment and Port of Entry inspections); the infeasibility of complete inspection greatly increases the potential of the introduction of exotic organisms; the treatment(s) of the growing media may not be entirely efficacious; the continual hazard of pest infestation/reinfestation of @clean@ plants.

2. Assessment of Weediness Potential of *Buxus* spp.

The results of the weediness screening for *Buxus* (Table 1) did not prompt a pest-initiated risk assessment.

Table 1: Process for Determining Weediness Potential of Commodity

Commodity: *Buxus spp. (Buxaceae)*

Phase 1: The genus *Buxus* consists of some 30 species of cultivated ornamental evergreen shrubs and small trees native to Western Europe, the Mediterranean, temperate East Asia, the West Indies, and Central America. *Buxus sempervirens* L., the Common Box, has long been cultivated in the United States.

Phase 2: Answer Yes or No to the following questions:

Is the genus listed in:

NO *Geographical Atlas of World Weeds*(Holm et al., 1979)

NO *World's Worst Weeds*(Holm et al., 1977)

NO *Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for Federal Noxious Weed Act*(Gunn & Ritchie, 1982)

NO *Economically Important Foreign Weeds*(Reed, 1977)

NO *Weed Science Society of America* list (WSSA, 1989)

NO Is there any literature reference indicating weediness, e.g. *AGRICOLA, CAB, Biological Abstracts, AGRIS*; search on "species name" combined with "weed").

Phase 3: Conclusion:

- IF:**
1. The species is widely prevalent in the United States and the answer to all of the questions is **no**...Proceed with the pest risk assessment.
 2. The species is widely prevalent in the United States and the answer to **one or more** of the questions is **yes**...Proceed with the pest risk assessment, provide comments on findings in text, and incorporate findings regarding weediness into the Risk Elements described below.
 3. The species is new to or not widely prevalent in the United States and the answer to all of the questions is **no**...Proceed with the pest risk assessment.
 4. The species is new to or not widely prevalent in the United States and the answer to **one or more** of the questions is **yes**...Consult authority under the Federal Noxious Weed Act for listing plant species as a noxious weed and consider the advisability of performing a pest-initiated pest risk assessment on the plant species. Provide explanations of findings in text.

3. Previous Risk Assessments, Current Status and Pest Interceptions

Decision History for *Buxus* spp. from China

None

Pest Interceptions on *Buxus* from China - FY85-95

Aleurotuberculatus sp. (Homoptera: Aleyrodidae)
Diaspididae sp. (Homoptera)
Eurytoma sp. (Hymenoptera: Eurytomidae)
Parlagena buxi (Takahashi) (Homoptera: Diaspididae)
Parlatoria sp. (Homoptera: Diaspididae)
Microsphaeropsiss sp.
Sminthuridae sp. (Collembola)

4. Pests associated with *Buxus* spp. in ChinaTable 2. Pests of *Buxus*

Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
ARTHROPODA AND MOLLUSCA				
<i>Adoretus sinicus</i> Burmeister (Coleoptera: Scarabaeidae)	CN, HI	Camellia, Diospyros, Rosa, Frimiana, Vitis, Theobroma, Morus, Populus, Asparagus, Abelmoschus, Gossypium, Phaseolus	z(soil), h, n	China, 1995, INKTO No. 89; CFR 318.13
<i>Agrotis segetum</i> (D. & S.) (Lepidoptera: Noctuidae)	CN	Citrus, Malus, Olea, Vitis, Zea	n	China, 1995; Carter, 1984; INKTO No. 25
<i>Aleurocanthus woglumi</i> Ashby (Homoptera: Aleyrodidae)	CN, FL, TX	Buxus, Citrus, Carica, Coffea, Fortunella, Swinglea, Pyrus, Triphasia, Annona, Cydonia, Diospyros, Myrtus, Mangifera	g, n, z	CIE 1976; PNKTO, No. 15
<i>Aleurotuberculatus hikosanensis</i> Takahashi (Homoptera: Aleyrodidae)	CN	Buxus, Cinnamomum, Ilex, Eurya, Pittosporum	z	Mound and Halsey, 1978; China, 1995
<i>Aleurotuberculatus</i> sp. (Homoptera: Aleyrodidae)	CN	Buxus	n, z	China, 1995; PPQ interception
<i>Amphimallon solstitialis</i> (L.) (Coleoptera: Scarabaeidae)	CN	Beta, Pinus, Solanum, polyphagous	n, z(soil)	Browne, 1968; China, 1995 CIE, 1979; INKTO, No. 99.
<i>Anomala corpulenta</i> Motschulsky (Coleoptera: Scarabaeidae)	CN	Bases, Cunninghamia, Juglans, Juniperus, Pinus, Malus, Prunus, Sabina, Salix, Ulmus, Vericia	z (soil)	China, 1994, 1995

Table 2. Pests of *Buxus*

Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
<i>Anomala cupripes</i> Hope (Coleoptera: Scarabaeidae)	CN	Buxus, Camellia, Delonix, Ficus, Dimocarpus, Hevea, Litchi, Mangifera	z (soil)	China, 1994, 1995, Gordon, 1994
<i>Aonidiella aurantii</i> (Maskell) (Homoptera: Diaspididae)	CN, US	Buxus, Citrus, Persea, polyphagous	c, z	China, 1994; CIE, 1968a; Dekle, 1965; Li and Liao, 1990; Nakahara, 1982
<i>Aphis fabae</i> (Scopoli) (Homoptera: Aphididae)	CN, US	Buxus, polyphagous	c, m	CIE, 1963; Stoetzel, 1994
<i>Aphis gossypii</i> Glover (Homoptera: Aphididae)	CN, US	polyphagous	c	China, 1995; CIE, 1968b
<i>Aphis rumicis</i> L. (Homoptera: Aphididae)	CN, US	Buxus, polyphagous	c, m	Smith and Parron, 1978; Wilson and Vickery, 1981; Zhang & Zhong, 1983
<i>Aporia crataegi</i> L. (Lepidoptera: Pieridae)	CN	Crataegus, Malus, Prunus, Pyrus, Salix, Ulmus, polyphagous	n	Anonymous, 1972, 1986; China, 1995; INKTO No. 149
<i>Ascotis selenaria</i> Schiffermuller & Denis (Lepidoptera: Geometridae)	CN	<i>Buxus, Rosa, Sophora</i>	z, z(soil)	China, 1994, 1995
<i>Aspidiotus destructor</i> Signoret (Homoptera: Diaspididae)	CN, US	Buxus, Cocos, Pandanus, polyphagous	c, m	CIE, 1966a; Dekle, 1965; Nakahara, 1982
<i>Aspidiotus nerii</i> Bouché (Homoptera: Diaspididae)	CN, US	Buxus, polyphagous	c, z	China, 1994; Dekle, 1965; Nakahara, 1982
<i>Atractomorpha sinensis</i> Bol. (Orthoptera: Acrididae)	CN	Serissa, Oryza, Saccharum, Citrus, Morus, Cinnamomum, Salix, Prunus, Sapium, Rosa, Camellia, Ipomoea, Malus, Gossypium, Nocotiana, Zea, Triticum, Impatiens, Chrysanthemum	z (soil)	China, 1994, 1995
<i>Bradybaena ravida</i> (Benson) (Mollusca: Bradybaenidae)	CN	Ehretia, Cymbidium, Iris, Chrysanthemum, Gardenia, Rosa, Prunus	n, z(soil), z _e	PPQ interception, China, 1995; Likhachev and

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Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
				Rammelmeier, 1962
<i>Bradybaena similaris</i> (Ferussac) (Mollusca: Bradybaenidae)	CN, US	Sageretia, Serissa, polyphagous	c, z _e , z(soil)	Chang and Chen, 1989; China, 1994; Dundee, 1970; Yen 1943
<i>Brevipalpus obovatus</i> Donnadiieu (Acari: Tenuipalpidae)	CN, US	Buxus, polyphagous	c, z	China, 1994; Jeppson <i>et al.</i> , 1975
<i>Calospilos suspecta</i> (Warren) (Lepidoptera: Geometridae)	CN	Buxus	z (soil), z	China, 1995; Zheng & Li, 1987
<i>Ceroplastes pseudoceriferus</i> Green (Homoptera: Coccidae)	CN	Buxus, Camellia, Cedrus, Chaenomeles, Citrus, Cycas, Cunninghamia, Diospyros, Gardenia, Ilex, Magnolia, Morus, Nandina, Pinus, Podocarpus, Punica, Rosa, Salix, Ulmus, Litchi, Mangifera, Rosaceae	z	China, 1994, 1995; Park <i>et al.</i> , 1990
<i>Ceroplastes floridensis</i> Comstock (Homoptera: Coccidae)	CN, US	Buxus, polyphagous	c, m	Hamon and Williams, 1984; Rawhy, <i>et al.</i> , 1973; Saad, 1977
<i>Ceroplastes japonicus</i> Green (Homoptera: Coccidae)	CN	Buxus, Camellia, Gardenia, Prunus, Morus, Podocarpus, Malus, Magnolia, Citrus, Pyrus, Michelia	n, z	China, 1994, 1995; Gimpel, 1974; Kozar, <i>et al.</i> , 1984
<i>Chrysodeixis chalcites</i> (Esper) (Lepidoptera: Noctuidae)	CN	Ficus, Brassica, Coffea, Cucumis, Cucurbita, Cynara, Echium, Glycine, Gossypium, Lycopersicon, Marrubium, Medicago, Nicotiana, Phaseolus, Salvia, Solanum, Trifolium, Utica, Zea	n	China, 1995; CIE, 1977; Goodey, 1991; Taylor, 1980
<i>Chrysomphalus aonidum</i> L. (Homoptera: Diaspididae)	CN, US	Buxus, polyphagous	c, m	CIE, 1988a; Dekle, 1965; Nakahara, 1982
<i>Chrysomphalus dictyospermi</i> (Morgan) (Homoptera: Diaspididae)	CN, US	Buxus, Podocarpus, polyphagous	c, m	CIE, 1969; Dekle, 1965; Garonna and Viggiani, 1989;

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Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
				Johnson & Lyon, 1982; Nakahara, 1982
<i>Clania minuscula</i> Butler (Lepidoptera: Psychidae)	CN	Buxus, Acer, Bischofia, Camellia, Cupressus, Citrus, Lagerstroemia, Platanus, Punica, Salix, Sapium, Pinus, Ulmus, Pyrus, Prunus, Pyrus, Podocarpus, Vitis, Malus, Morus, Thea, Rosa, Ribes, Rubus, Castanea, Quercus, Salix, Populus, Fraxinus, Magnolia	z	China, 1994, 1995; Kozhanchikov 1956; Shiraki, 1952
Coccidae, sp. (Homoptera: Coccidae)	CN	Buxus	n, z	China, 1994, 1995
<i>Conogethes punctiferalis</i> (Guenée) (Lepidoptera: Pyralidae)	CN	Gossypium, Helianthus, Castanea, Pinus, Prunus, Pyrus, Sorghum, Zea	n	China, 1995; INKTO
<i>Cryptothela variegata</i> Snellen (Lepidoptera: Psychidae)	CN	Buxus, Ginkgo, Malus, Pinus, Podocarpus, Rosa, Ulmus, Pyracantha, Casurina, Cinnamomum	z	Browne, 1968; China, 1994; 1995; Kozhanchikov, 1956
Diaspididae sp. (Homoptera: Diaspididae)	CN	Buxus	n, z	China, 1995; PPQ interception
<i>Drosicha corpulenta</i> (Kuwana) (Homoptera: Margarodidae)	CN	Buxus, Ficus, Magnolia, Paulownia, Plantanus, Salix, Melia, Sophora, Podocarpus, Ziziphus, Diospyros, Malus, Pyrus, Citrus, Prunus, Castanea, Quercus	z (soil), z	China, 1994, 1995; Shiraki, 1952
<i>Eurytoma</i> sp. (Hymenoptera: Eurytomidae)	CN	Buxus	z _e	PPQ interception
<i>Glyphodes perspectalis</i> (Walker) (Lepidoptera: Pyralidae)	CN	Buxus	z	Tang <i>et al.</i> , 1990
<i>Gryllotalpa africana</i> Palisot de Beauvois (Orthoptera: Gryllotalpidae)	CN	Solanum, Saccharum, Gossypium, Vitis, Fragaria, Camellia, Dianthus, Prunus, Fortunella, Pinus, Nictotiana	n, z (soil)	China, 1995; INKTO, No. 197
<i>Helicoverpa armigera</i> (Hübner) (Lepidoptera: Noctuidae)	CN	Glycine, Gossypium, Lycopersicon, Medicago,	n	China, 1995; CIE, 1993a; Avidov and

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(Lepidoptera: Noctuidae)		Nicotiana, Solanum, Tagetes, Triticum, Zea		Harpaz, 1969
<i>Helicoverpa assulta</i> (Guenée) (Lepidoptera: Noctuidae)	CN	Capsicum, Cucumis, Gossypium, Ipomoea, Nicotiana, Sorghum, Zea	n	China, 1995; CIE, 1994
<i>Icerya aegyptica</i> (Douglas) (Homoptera: Margarodidae)	CN	Citrus, Cinnamomum, Diospyros, Ficus, Morus, Psidium, >100 hosts	n	China, 1995; CIE, 1966b; INKTO No. 119; Williams, 1985
<i>Icerya purchasi</i> Maskell (Homoptera: Margarodidae)	CN, US	Buxus, polyphagous	c, z	China, 1994, CIE, 1971; Myer, 1978; Salama, <i>et al.</i> , 1985
<i>Icerya seychellarum</i> (Westwood) (Homoptera: Margarodidae)	CN	Sapium, Camellia, Acer, Podocarpus, Psidium, Citrus, Pyrus, Prunus, Rosa, Cycas, Eriobotrya, Morus, Thea, Trachycarpus, >100 hosts	n	China, 1995; CIE, 1955; PNKTO, No. 21
<i>Lycorma delicatula</i> White (Homoptera: Fulgoridae)	CN	Buxus, Catalpa, Glycine, Ligustrum, Malus, Melia, Populus, Platanus, Prunus, Quercus, Ulmus, Toona	z	China, 1994, 1995; Mahmood, 1976; Metcalf, 1947
<i>Mamestra brassicae</i> (L.) (Lepidoptera: Noctuidae)	CN	Beta, Brassica, Daucus, Gossypium, Morus, Pisum, Nicotiana, Saccharum, Solanum, Triticum, Vicia	n	China, 1995; INKTO, No. 61
<i>Myzus persicae</i> (Sulzer) (Homoptera: Aphididae)	CN, US	Buxus, polyphagous	c	Blackman and Eastop, 1994; Zhang & Zhong, 1983
<i>Parasaissetia nigra</i> (Nietner) (Homoptera: Coccidae)	CN, US	Buxus, polyphagous	c, m	Hamon and Williams, 1984;
<i>Parlagena buxi</i> (Takahashi) (Homoptera:Diaspididae)	CN	Buxus, Euonymus, Ulmus Ziziphus	n, z	China, 1994, 1995; PPQ interception
<i>Parlatoria pergandii</i> Comstock (Homoptera: Diaspididae)	CN, US	Buxus, polyphagous	c, z	China, 1994, Dekle, 1965; Nakahara, 1982; Shen and Liu, 1990
<i>Parlatoria proteus</i> (Curtis) (Homoptera: Diaspididae)	CN, US	Buxus, polyphagous	z	Dekle, 1965; Nakahara, 1982

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<i>Parlatoria</i> sp. (Homoptera: Diaspididae)	CN	<i>Buxus</i>	n, z	China, 1995; PPQ interception
<i>Parlatoria ziziphi</i> (Lucas) (Homoptera: Diaspididae)	CN, FL, HI	<i>Buxus</i> , <i>Citrus</i>	g, z	China, 1994; CIE, 1964; PNKTO, No. 15
<i>Phyllophaga</i> sp. (Coleoptera: Scarabaeidae)	CN	Serissa, polyphagous	n, z(soil), z _e	China, 1995; PPQ interception
<i>Phyllophaga titanis</i> Reitter (Coleoptera: Scarabaeidae)	CN	<i>Buxus</i> , <i>Rosa</i> , <i>Sophora</i> , <i>Ulmus</i> , polyphagous	z (soil)	China, 1994, 1995; Gordon, 1994
<i>Pinnaspis buxi</i> Bouché (Homoptera; Diaspididae)	CN, US	<i>Buxus</i> , <i>Coccus</i> , <i>Pandanus</i> , <i>Citrus</i> , polyphagous	c, z	Nakahara, 1982; Song, et al, 1989
<i>Pinnaspis strachani</i> (Cooley) (Homoptera: Diaspididae)	CN, US	<i>Buxus</i> , polyphagous	c, m	Dekle, 1965; Nakahara, 1982
<i>Pryeria sinica</i> Moore (Lepidoptera: Zygaenidae)	CN	<i>Buxus</i> , <i>Euonymus</i>	z	Anonymous, 1986; China, 1994, 1995
<i>Pseudaonidia clavigera</i> (Ckll) (Homoptera: Diaspididae)	CN, US	<i>Buxus</i> , polyphagous	c, m	Dekle, 1965; Nakahara, 1982
<i>Pseudaulacaspis pentagona</i> (Targioni & Tozzetti) (Homoptera: Diaspididae)	CN, US	<i>Buxus</i> , <i>Diospyros</i> , <i>Prunus</i> , <i>Melia</i> , polyphagous	m	Dekle, 1965; Nakahara, 1982
<i>Rhizoecus hibisci</i> Kawai & Takagi (Homoptera: Pseudococcidae)	CN, HI	Serissa, <i>Cryptanthus</i> , <i>Carex</i> , <i>Rhaphis</i> , <i>Crinum</i> , <i>Cuphea</i> , <i>Hibiscus Dieffenbachia</i> , <i>Hakonechloa</i> , <i>Nerium</i> , <i>Pelargonium</i> , <i>Phoenix</i> , <i>Sabal</i> , <i>Zelkova</i>	z (soil)	EPPO, 1996a, b
<i>Ricania sublimbata</i> Jacobi (Homoptera; Ricanidae)	CN	<i>Buxus</i> , <i>Citrus</i> , <i>Ligustrum</i>	z (oviposition in xylem)	China, 1995; Xu and Zhong, 1988
<i>Saissetia coffeae</i> (Walker) (Homoptera: Coccidae)	CN, US	<i>Buxus</i> , polyphagous	m	CIE, 1973a; Hamon and Williams, 1984; Squire, 1972
<i>Sminthuridae</i> , sp. (Collembola: Sminthuridae)	CN	<i>Buxus</i>	n, z	China, 1995; PPQ interception
<i>Spodoptera litura</i> (F.) (Lepidoptera: Noctuidae)	CN	Arachis, Beta, Brassica, <i>Citrus</i> , Glycine, <i>Gossypium</i> ,	n	China, 1995; CIE, 1993b; INKTO,

Table 2. Pests of *Buxus*

Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
		Ipomoea, Morus, Nicotiana, Oryza, Solanum, Sorghum, Ulmus, Zea		No. 12
<i>Sympiezomias velatus</i> Chevrolet (Coleoptera: Curculionidae)	CN	Sophora, Populus, Morus, Glycine, Beta, Castanea, 70 genera, 101 species recorded.	z(soil), z	China, 1995
<i>Thosea sinensis</i> (Walker) (Lepidoptera: Limacodidae)	CN	Buxus, Acer, Cinnamomum, Diospyros, Malus, Metasequoia, Osmanthus, Paulownia, Zizyphus	n, z	Bourke <i>et al.</i> , 1969; China, 1994, 1995; Hu and Wang, 1969
<i>Thrips palmi</i> Karny (Thysanoptera: Thripidae)	CN, FL, HI	polyphagous	g, n	CIE, 1992; Smith <i>et al.</i> , 1992
<i>Tridactylus japonicus</i> de Hoan (Orthoptera: Trydactilidae)	CN	Buxus, Camellia, Cedrus, Fragaria, Gossypium, Oryza Nicotiana, Rosa, Sabina, Saccharinum	z (soil), z	China, 1994, 1995; Shiraki, 1952
<i>Unaspis yanonensis</i> (Kuwana) (Homoptera: Diaspididae)	CN	Buxus, Citrus, Camellia, Punica, Osmanthus, Prunus	n, z	China, 1994, 1995; CIE, 1988b; PNKTO, No. 45; Reu <i>et al.</i> , 1990; Tanaka, 1981; Wang, 1981
<i>Zeuzera coffeae</i> Nietner (Lepidoptera: Cossidae))	CN	Buxus, Gossypium, Metasequoia, Platanus, Pterocarya, Punica, Sapium, Sophora, Zea	z	China, 1994, 1995; CIE, 1973b; Tang, <i>et al.</i> , 1990
FUNGI				
<i>Cercospora destructiva</i> (Ravenel) Ellis & Everh. (Fungi Imperfecti, Hyphomycetes)	CN, US	Buxus, Euonymus	o,Zei	China, 1992; Farr, <i>et al.</i> , 1989
<i>Dennisiella babingtonii</i> (Berk.) Batista & Cif. Anamorph: <i>Microxiphium fagi</i> (Pers.) S. J. Hughes (Loculoascomycetes, Dothideales)	CN, US	Buxus, Ilicium	o,Zei	China, 1992; Farr, <i>et al.</i> , 1989
<i>Fusarium oxysporum</i> Schlechtend.:Fr. (Fungi Imperfecti, Hyphomycetes)	CN, US	Buxus, Various genera	o,Zei	China, 1992; Farr <i>et al.</i> , 1989
<i>Glomerella cingulata</i> (Stoneman)	CN, US	Buxus, Various genera	o,Zei	Farr <i>et al.</i> , 1989

Table 2. Pests of *Buxus*

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Spaulding & Schrenk Anamorph: <i>Colletotrichum gloeosporoides</i> (Penz.) Penz., & Sacc. in Penz. (Pyrenomycetes, Phyllachorales)				
<i>Guignardia miribelia</i> van der Aa Anamorph: <i>Sarcophoma miribelia</i> (Fr.) Hohn. Syn.: <i>Macrophoma miribelia</i> (Fr.) Berl. & Vogl. (Loculoascomycetes, Dothideales)	CN	Buxus	z _{ei}	China, 1995; Sutton, 1980
<i>Macrophoma ehretiae</i> Cook & Mass. (Fungi Imperfecti, Coelomycetes)	CN	Buxus, Ehretia	z _{ei}	China, 1995; Farr, et al., 1989; Tai, 1979
<i>Meliola buxicola</i> Doidge (Pyrenomycetes, Meliolales)	CN	Buxus	z _{ei}	Tai, 1979
<i>Microsphaera euonymi-japonici</i> Vien.-Bourg. Anamorph: <i>Oidium euonymi-japonici</i> (Arcang.) Sacc. in E. S. Salmon (Pyrenomycetes, Erysiphales)	CN, US	Euonymus	o,z _{ei}	China, 1992; Farr, 1994; Farr, et al., 1989
<i>Pestalotia breviseta</i> Sacc. (Fungi Imperfecti, Coelomycetes)	CN, US	Acacia, Buxus, Quercus	o,z _{ei}	China, 1992; Farr et al., 1989
<i>Phoma</i> sp. (Fungi Imperfecti, Coelomycetes)	CN	Buxus	z _{ei}	China, 1992; PPQ interception
<i>Phyllosticta nandinae</i> Tassi (Fungi Imperfecti, Coelomycetes)	CN, US	Buxus, Nandina	o,z _{ei}	China, 1992; Farr et al., 1989
<i>Puccinia buxi</i> DC Syn.: <i>Dasyspora buxi</i> Arth. (Basidiomycetes, Uredinales)	CN	Buxus	n,z _{ei}	BATS 309 Database, 1990; China, 1992; Farr, 1994; Smith, et al., 1988
<i>Thanatephorus cucumeris</i> (A.B. Frank) Donk Anamorph: <i>Rhizoctonia solani</i> Kühn (Basidiomycetes, Tulasnellales)	CN, US	Various genera	o,z _{ei}	China 1992; Teng, 1996
NEMATODA				

Table 2. Pests of *Buxus*

Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
<i>Aphelenchoides besseyi</i> Christie (Aphelenchoididae)	CN, US	Various genera	z(soil)	Anonymous, 1984; EPPO, 1996a
<i>Aphelenchus</i> sp. (Species unknown) (Aphelenchidae)	CN	Unknown	z(soil)	EPPO, 1996a
<i>Criconemella</i> sp. (Species unknown) (Criconematidae)	CN	Unknown	z(soil)	EPPO, 1996a
Dorylaimidae (Genus and species unknown) (Dorylaimidae)	CN	Unknown	z(soil)	EPPO, 1996a
<i>Dorylaimus</i> sp. (Species unknown) (Dorylaimidae)	CN	Unknown	z(soil)	EPPO, 1996b
<i>Helicotylenchus</i> sp. (Species unknown) (Hoplolaimidae)	CN	Unknown	z(soil)	EPPO, 1996a; 1996b
<i>Helicotylenchus dihystera</i> (Cobb) Sher Syn: <i>Tylenchus dihystera</i> Cobb (Hoplolaimidae)	CN, US	Buxus, Various genera	o, z(soil)	Anonymous, 1984; China 1992; 1995; EPPO, 1996a; 1996b
<i>Hirschmanniella</i> sp. (Species unknown) (Pratylenchidae)	CN	Unknown	z(soil)	EPPO, 1996a; 1996b
<i>Meloidogyne incognita</i> (Chitwood) (Heteroderidae)	CN, US	Buxus, Various genera	o, z(soil)	Anonymous, 1984; China, 1992
<i>Meloidogyne</i> sp. (Species unknown) (Heteroderidae)	CN	Unknown	z(soil)	EPPO, 1996b
<i>Nacobbus aberrans</i> (Thorne) Thorne & Allen Syn.: <i>Pratylenchus aberrans</i> (Thorne) Filipjev (Nacobidae)	CN, US	Buxus, Various genera	o, z(soil)	Anonymous, 1984; China, 1992
<i>Paratrophorus</i> sp. (Species unknown) (Belonolaimidae)	CN	Unknown	z(soil)	EPPO, 1996a

Table 2. Pests of *Buxus*

Scientific name	Dist. ¹	Host Genera ²	Codes ³	References
<i>Pratylenchus brachyurus</i> (Godfrey) Filipjev & Schuurmans Stekhoven (Pratylenchidae)	CN, US	Various genera	o, z(soil)	Anonymous, 1984; EPPO, 1996b
<i>Pratylenchus penetrans</i> (Cobb) Filipjev & Stekhoven (Pratylenchidae)	CN, US	Buxus, Various genera	o, z(soil)	Anonymous, 1984; China, 1995
<i>Pratylenchus</i> sp. (Species unknown) (Pratylenchidae)	CN	Unknown	z(soil)	EPPO, 1996a; 1996b
<i>Rotylenchus robustus</i> (deMan) Filipjev (Hoplolaimidae)	CN, US	Various genera	o, z(soil)	EPPO, 1996b
<i>Trichodorus</i> sp. (Species unknown) (Trichodoridae)	CN	Unknown	z(soil)	EPPO, 1996a
<i>Tylenchorhynchus</i> sp. (Species unknown) (Tylenchorhynchidae)	CN	Unknown	z(soil)	EPPO, 1996a
<i>Tylenchorhynchus crassicaudatus</i> Williams (Tylenchorhynchidae)	CN	Oryza	z(soil)	EPPO, 1996a; 1996b
<i>Tylenchorhynchus levitermalis</i> Siddiqi, Mukherjee & Dasgupta (Tylenchorhynchidae)	CN, not in US	Unknown	z(soil)	EPPO, 1996a; 1996b
<i>Tylenchus</i> sp. (Species unknown) (Tylenchidae)	CN	Unknown	z(soil)	EPPO, 1996a
<i>Xiphinema brasiliense</i> Lordello (Longidoridae)	CN, US (FL)		o, z(soil)	EPPO, 1996b
<i>Xiphinema</i> sp. (Species unknown) (Longidoridae)	CN	Unknown	z(soil)	EPPO, 1996a; 1996b

¹Geographical distribution is denoted as follows: CN-People's Republic of China, FL-Florida, HI-Hawaii, TX-Texas, US- United States

²Host genera identified in literature and by CAPQ

³Codes: c - Listed in USDA catalogue of intercepted pests as non-actionable.

e - Although pest attacks commodity, it would not be expected to remain with the commodity (plant

part) during processing

- g - Quarantine pest; pest has limited distribution in the U.S. and is under official control as follows:
pest listed by name in USDA's pest dictionary, official quarantine action may be taken on this pest when intercepted on this commodity.
- h - Quarantine pest; pest has limited distribution in the U.S. and is under official control as follows:
(1) pest listed by name in USDA's pest dictionary, official quarantine action may be taken on this pest when intercepted on this commodity and, (2) pest is a program pest (there is an official Federal or recognized State program for control of this pest beyond its being listed in the pest dictionary as actionable.)
- m - the pest occurs within the PRA area and has been reported to attack the specified host species in other geographic regions; but has not been reported to attack the specified host species in the PRA area.
- n - Listed in the USDA catalogue of intercepted pests as actionable.
- o - Organism does not meet the geographical and regulatory definition for a quarantine pest.
- z_i - Internal feeder: Pest is known to attack or infect commodity and it would be reasonable to expect the pest may remain with the commodity during processing and shipping
- z_e - External feeder: Pest is known to commonly attack or infect commodity and it would be reasonable to expect the pest may remain with the commodity during processing and shipping.

5. List of Quarantine Pests

Table 3. Quarantine Pests - *Buxus*

ARTHROPODA

- Adoretus sinicus* Burmeister (Coleoptera: Scarabaeidae)
Agrotis segetum (D. & S.) (Lepidoptera: Noctuidae)
Aleurocanthus woglumi Ashby (Homoptera: Aleyrodidae)
Aleurotuberculatus hikosanensis Takahashi (Homoptera: Aleyrodidae)
Amphimallon solstitialis (L.) (Coleoptera: Scarabaeidae)
Anomala corpulenta Motschulsky (Coleoptera: Scarabaeidae)
Anomala cupripes Hope (Coleoptera: Scarabaeidae)
Aporia crataegi L. (Lepidoptera: Pieridae)
Ascotis selenaria Schiffer-Muller & Denis (Lepidoptera: Geometridae)
Atractomorpha sinensis Bol. (Orthoptera: Acrididae)
Calospilos suspecta (Warren) (Lepidoptera: Geometridae)
Ceroplastes pseudoceriferus Green (Homoptera: Coccidae)
Ceroplastes japonicus Green (Homoptera: Coccidae)
Chrysodeixis chalcites (Esper) (Lepidoptera: Noctuidae)
Clania minuscula Butler (Lepidoptera: Psychidae)
Conogethes punctiferalis (Guenée) (Lepidoptera: Pyralidae)
Cryptothela variegata Snellen (Lepidoptera: Psychidae)
Drosicha corpulenta (Kuwana) (Homoptera: Margarodidae)
Glyphodes perspectalis (Walker) (Lepidoptera: Pyralidae)
Gryllotalpa africana Palisot de Beauvois (Orthoptera: Gryllotalpidae)
Helicoverpa armigera (Hübner) (Lepidoptera: Noctuidae)
Helicoverpa assulta (Guenée) (Lepidoptera: Noctuidae)
Icerya aegyptica (Douglas) (Homoptera: Margarodidae)
Icerya seychellarum (Westwood) (Homoptera: Margarodidae)
Lycorma delicatula White (Homoptera: Fulgoridae)
Mamestra brassicae (L.) (Lepidoptera: Noctuidae)
Parlagena buxi (Takahashi) (Homoptera: Diaspididae)
Parlatoria ziziphi (Lucas) (Homoptera: Diaspididae)
Phyllophaga titanis Reitter (Coleoptera: Scarabaeidae)
Pryeria sinica Moore (Lepidoptera: Zygaenidae)
Rhizoecus hibisci Kawai & Takagi (Homoptera: Pseudococcidae)
Ricania sublimbata Jacobi (Homoptera: Ricanidae)
Spodoptera litura (F.) (Lepidoptera: Noctuidae)
Sympiezomias velatus Chevrolet (Coleoptera: Curculionidae)
Thosea sinensis (Walker) (Lepidoptera: Limacodidae)
Thrips palmi Karny (Thysanoptera: Thripidae)
Tridactylus japonicus de Hoan (Orthoptera: Trydactilidae)
Unaspis yanponensis (Kuwana) (Homoptera: Diaspididae)
Zeuzera coffeae Nietner (Lepidoptera: Cossidae)

MOLLUSCA

Bradybaena ravida (Benson) (Mollusca: Bradybaenidae)

FUNGI

Guignardia miribelii van der Aa (Loculoascomycetes, Dothideales)
Macrophoma ehretiae Cook & Mass. (Fungi Imperfecti, Coelomycetes)
Meliola buxicola Doidge (Pyrenomycetes, Meliolales)
Puccinia buxi DC (Basidiomycetes, Uredinales)

NEMATODA

Paratrophorus sp. (Belonolaimiidae)
Tylenchorhynchus crassicaudatus (Tylenchorhynchidae)
Tylenchorhynchus levitermalis (Tylenchorhynchidae)

6. Quarantine Pests Likely to Follow Pathway

Table 4. Quarantine Pests Likely to Follow Pathway - *Buxus*

ARTHROPODA

Adoretus sinicus Burmeister (Coleoptera: Scarabaeidae)
Aleurocanthus woglumi Ashby (Homoptera: Aleyrodidae)
Aleurotuberculatus hikosanensis Takahashi (Homoptera: Aleyrodidae)
Amphimallon solstitialis (L.) (Coleoptera: Scarabaeidae)
Anomala corpulenta Motschulsky (Coleoptera: Scarabaeidae)
Anomala cupripes Hope (Coleoptera: Scarabaeidae)
Ascotis selenaria Schiffer-Muller & Denis (Lepidoptera: Geometridae)
Atractomorpha sinensis Bol. (Orthoptera: Acrididae)
Calospilos suspecta (Warren) (Lepidoptera: Geometridae)
Ceroplastes pseudoceriferus Green (Homoptera: Coccidae)
Ceroplastes japonicus Green (Homoptera: Coccidae)
Clania minuscula Butler (Lepidoptera: Psychidae)
Cryptothoelea variegata Snellen (Lepidoptera: Psychidae)
Drosicha corpulenta (Kuwana) (Homoptera: Margarodidae)
Glyphodes perspectalis (Walker) (Lepidoptera: Pyralidae)
Gryllotalpa africana Palisot de Beauvois (Orthoptera: Gryllotalpidae)
Lycorma delicatula White (Homoptera: Fulgoridae)
Parlagena buxi (Takahashi) (Homoptera: Diaspididae)
Parlatoria ziziphi (Lucas) (Homoptera: Diaspididae)
Phyllophaga titanis Reitter (Coleoptera: Scarabaeidae)
Pryeria sinica Moore (Lepidoptera: Zygaenidae)
Rhizoecus hibisci Kawai & Takagi (Homoptera: Pseudococcidae)
Ricania sublimbata Jacobi (Homoptera: Ricaniidae)
Thosea sinensis (Walker) (Lepidoptera: Limacodidae)
Thrips palmi Karny (Thysanoptera: Thripidae)
Tridactylus japonicus de Hoan (Orthoptera: Trydactilidae)
Unaspis yanonensis (Kuwana) (Homoptera: Diaspididae)
Zeuzera coffeae Nietner (Lepidoptera: Cossidae)

MOLLUSCA

Bradybaena ravidula (Benson) (Mollusca: Bradybaenidae)

FUNGI

Guignardia miribelii van der Aa (Loculoascomycetes, Dothideales)
Macrophoma ehretiae Cook & Mass. (Fungi Imperfici, Coelomycetes)
Meliola buxicola Doidge (Pyrenomycetes, Meliolales)
Puccinia buxi DC (Basidiomycetes, Uredinales)

NEMATODA

Paratrophorus sp. (Belonolaimiidae)
Tylenchorhynchus crassicaudatus (Tylenchorhynchidae)
Tylenchorhynchus levitermalis (Tylenchorhynchidae)

Other organisms in this Assessment, not chosen for further scrutiny, may be potentially detrimental to the agricultural production systems of the United States. However, there were a

variety of reasons for not subjecting them to further analysis: they maybe associated with the commodity (however, it was not considered reasonable to expect these pests to remain with the commodity during processing); they have been intercepted, as biological contaminants, by PPQ Officers during inspections of these commodities and would not be expected to be found with every shipment.

7. Economic Importance: Consequences of Introduction

Pests rated for potential economic importance are evaluated against five biological factors. The cumulative score for these elements is the Risk Rating (USDA, 1995).

Table 5: Risk Rating - Consequences of Introduction

Pest	Climate/ Host	Host Range	Dispersal	Economic	Environ- mental	Risk Rating
<i>Adoretus sinicus</i>	H	H	H	M	M	H
<i>Aleurocanthus woglumi</i>	H	H	H	M	M	H
<i>Aleurotuberculatus hikosanensis</i>	H	H	H	M	M	H
<i>Amphimallon solstitialis</i>	H	H	H	M	M	H
<i>Anomala corpulenta</i>	H	H	H	M	M	H
<i>Anomala cupripes</i>	H	H	H	M	M	H
<i>Ascotis selenaria</i>	H	H	H	M	M	H
<i>Atractomorpha sinensis</i>	H	H	H	M	M	H
<i>Bradybaena ravida</i>	H	H	H	M	M	H
<i>Calospilos suspecta</i>	H	L	H	M	M	M
<i>Ceroplastes pseudoceriferus</i>	H	H	H	M	M	H
<i>Ceroplastes japonicus</i>	H	H	H	M	M	H
<i>Clania minuscula</i>	H	H	H	M	M	H

<i>Cryptothlea variegata</i>	H	H	H	M	M	H
<i>Drosicha corpulenta</i>	H	H	H	M	M	H
<i>Glyphodes perspectalis</i>	H	L	H	M	M	M
<i>Gryllotalpa africana</i>	H	H	H	M	M	H
<i>Lycorma delicatula</i>	H	H	H	M	M	H
<i>Parlagena buxi</i>	H	H	H	M	M	H
<i>Parlatoria ziziphi</i>	H	H	H	M	M	H
<i>Phyllophaga titanis</i>	H	H	H	M	M	H
<i>Pryeria sinica</i>	H	H	H	M	M	H
<i>Rhizoecus hibisci</i>	H	H	H	M	M	H
<i>Ricania sublimbata</i>	H	H	H	M	M	H
<i>Thosea sinensis</i>	H	H	H	M	M	H
<i>Thrips palmi</i>	H	H	H	M	M	H
<i>Tridactylus japonicus</i>	H	H	H	M	M	H
<i>Unaspis yanonensis</i>	H	H	H	M	M	H
<i>Zeuzera coffeae</i>	H	H	H	M	M	H
<i>Guignardia miribelii</i>	H	L	H	M	M	M
<i>Macrophoma ehretia</i>	H	H	H	M	M	H
<i>Meliola buxicola</i>	H	L	H	M	M	M
<i>Puccinia buxi</i>	H	L	H	M	M	M
<i>Paratrophorus</i> sp.	H	M	H	M	M	H

<i>Tylenchorhynchus crassicaudatus</i>	H	M	H	M	M	H
<i>Tylenchorhynchus leviterminalis</i>	H	M	H	M	M	H

8. Likelihood of Introduction

The likelihood of introduction for a pest is rated relative to six factors (Tables 6 and 7) (USDA, 1995)

Table 6: Amount of Commodity Shipped	
Number of 40' Containers Annually	Rating
10 - 100	M

Table 7: Risk Rating - Likelihood of Introduction						
Pest	Likelihood of surviving postharvest treatment	Likelihood of surviving shipment	Likelihood of not being detected at port of entry	Likelihood of moving to suitable habitat	Likelihood of finding suitable hosts	Risk Rating
<i>Adoretus sinicus</i>	H	H	H	H	H	H
<i>Aleurocanthus woglumi</i>	H	H	M	H	H	H
<i>Aleurotuberculatus hikosanensis</i>	H	H	M	H	H	H
<i>Amphimallon solstitialis</i>	H	H	H	H	H	H
<i>Anomala corpulenta</i>	H	H	H	H	H	H
<i>Anomala cupripes</i>	H	H	H	H	H	H
<i>Ascotis selenaria</i>	H	H	H	H	H	H
<i>Atractomorpha sinensis</i>	H	H	H	H	H	H
<i>Bradybaena ravida</i>	H	H	H	H	H	H
<i>Calospilos suspecta</i>	H	H	H	H	H	H
<i>Ceroplastes pseudoceriferus</i>	H	H	M	H	H	H

<i>Ceroplastes japonicus</i>	H	H	M	H	H	H
<i>Clania minuscula</i>	H	H	M	H	H	H
<i>Cryptothelea variegata</i>	H	H	M	H	H	H
<i>Drosicha corpulenta</i>	H	H	H	H	H	H
<i>Glyphodes perspectalis</i>	H	H	M	H	H	H
<i>Gryllotalpa africans</i>	H	H	H	H	H	H
<i>Lycorma delicatula</i>	L	H	M	H	H	H
<i>Parlagena buxi</i>	H	H	M	H	H	H
<i>Parlatoria ziziphi</i>	H	H	M	H	H	H
<i>Phyllophaga titanis</i>	H	H	H	H	H	H
<i>Pryeria sinica</i>	H	H	M	H	H	H
<i>Rhizoecus hibisci</i>	H	H	H	H	H	H
<i>Ricania sublimbata</i>	H	H	H	H	H	H
<i>Thosea sinensis</i>	H	H	M	H	H	H
<i>Thrips palmi</i>	H	H	M	H	H	H
<i>Tridactylus japonicus</i>	H	H	H	H	H	H
<i>Unaspis yanonensis</i>	H	H	M	H	H	H
<i>Zuezera coffeae</i>	H	H	M	H	H	H
<i>Guignardia miribellii</i>	H	H	M	H	H	H
<i>Macrophoma ehretiae</i>	H	H	M	H	H	H
<i>Meliola buxicola</i>	H	H	M	H	H	H
<i>Puccinia buxi</i>	H	H	M	H	H	H
<i>Paratrophorus</i> sp.	H	H	H	H	H	H
<i>Tylenchorhynchus crassicaudatus</i>	H	H	H	H	H	H
<i>Tylenchorhynchus</i>						

<i>leviterinalis</i>	H	H	H	H	H	H
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9. Pest Risk Potential

Pest Risk Potential is the combination of the consequences and likelihood of introductions (Tables 5, 6 and 7) (USDA, 1995).

Table 8: Pest Risk Potential	
Pest	Pest Risk Potential
<i>Adoretus sinicus</i>	H
<i>Aleurocanthus woglumi</i>	H
<i>Aleurotuberculatus hikosanensis</i>	H
<i>Amphimallon solstitialis</i>	H
<i>Anomala corpulenta</i>	H
<i>Anomala cupripes</i>	H
<i>Ascotis selenaria</i>	H
<i>Atractomorpha sinensis</i>	H
<i>Bradybaena ravida</i>	H
<i>Calospilos suspecta</i>	H
<i>Ceroplastes pseudoceriferus</i>	H
<i>Ceroplastes japonicus</i>	H
<i>Clania minuscula</i>	H
<i>Cryptothlea variegata</i>	H
<i>Drosicha corpulenta</i>	H
<i>Glyphodes perspectalis</i>	H
<i>Gryllotalpa africans</i>	H
<i>Lycorma delicatula</i>	H
<i>Parlagena buxi</i>	H

<i>Parlatoria proteus</i>	H
<i>Parlatoria ziziphi</i>	H
<i>Phyllophaga titanis</i>	H
<i>Pryeria sinica</i>	H
<i>Rhizoecus hibisci</i>	H
<i>Ricania sublimbata</i>	H
<i>Thosea sinensis</i>	H
<i>Thrips palmi</i>	H
<i>Tridactylus japonicus</i>	H
<i>Unaspis yanonensis</i>	H
<i>Zeuzera coffeae</i>	H
<i>Guignardia miribelii</i>	H
<i>Macrophoma ehretiae</i>	H
<i>Meliola buxicola</i>	H
<i>Puccinia buxi</i>	H
<i>Paratrophorus</i> sp.	H
<i>Tylenchorhynchus crassicaudatus</i>	H
<i>Tylenchorhynchus leviterinalis</i>	H

Phytosanitary Measures

Numerous potential biological hazards are associated with the importation of propagative material in growing media. In the case of Chinese penjing, the plants are grown in the open, in proximity to the ground and in or around agricultural production areas. Other factors which exacerbate the pest risk are inadequate pest control, plants collected from the wild, the continual flow of plant material into and out of facilities and soil movement from adjacent agricultural areas. These conditions act in concert to produce a great potential for contaminants, pest organisms of plants from nature and windborne infestations to establish in the nursery stock.

From the perspective of this risk assessment, most of the organisms of concern (some arthropods, snails, nematodes and weed seeds) are soil inhabitants during at least one portion of their life histories. Other potential hazards include fungal fruiting bodies with a latent period. These

organisms have a high Pest Risk Potential and will require specific measures to insure phytosanitary security. Accordingly, mitigation measures based solely on Port of Entry inspections may be inadequate in providing this security. However, the choice of appropriate sanitary and phytosanitary measures to mitigate risks associated with these pest species is undertaken as part of Risk Management, and is not addressed, *per se*, in this document. Should additional pests, not identified in this Risk Assessment, be intercepted, appropriate quarantine action will be taken.

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